

Understanding Differences Along a Stream

It is important to understand what is happening in your catchment. Everything that flows into the creek or river at different points upstream may have a cumulative effect downstream. Water quality may be reduced, making it unfit for human consumption, swimming, fishing, livestock watering and irrigation, and unhealthy for the native aquatic flora and fauna. A watercourse may even become polluted to a point that causes the natural aquatic and riparian (riverbank) ecosystems to decline or change in species diversity and composition.

Some natural characteristics of your stream such as water temperature, flow rates, water depth, stream bottom composition and food sources will vary naturally along the stream's length. Results from biological surveys and physical and chemical water quality tests therefore need to be interpreted according to the location of the monitoring site in the catchment. For example, different results along a stream's length may be related to topography, impacts from adjoining land use or changes in soil type within the stream's catchment.

How catchments affect streams

To interpret monitoring results accurately, you will need to know about the natural changes along a stream's length before you can identify any human-induced ones. When these natural changes have been identified you can then focus on monitoring for human-induced changes. The following section outlines some of the natural changes that occur in a stream from its upper catchment to its lower catchment.

Upper catchment – the headwaters

In the upper reaches of the catchment in mountain regions or foothills, streams are usually fast-flowing. This means that they have the energy to carry large amounts and large-sized pieces of rock and gravel which have been eroded from stream beds and banks.

In forested areas, headwater streams are frequently shaded from the sun's warming rays by overhanging tree branches. These streams are often fed by groundwater that seeps to the surface at a constant cool temperature. This stream environment shows only small daily or seasonal changes in water temperature. Aquatic water life (macro-invertebrates) adapted to cooler water may be found here, such as stonefly nymphs.

Headwater streams in non-forested areas and streams fed largely by runoff from the land tend to show greater seasonal and daily changes in water temperature. In these streams, sunlight and air temperature have greater impacts on water temperature.

The type of stream bottom or substrate – bedrock, rocks, gravel, sand or silt – is determined in part by the water velocity and in part by the underlying geology of the area. Rocks, pebbles and bedrock are characteristic of fast-flowing headwater streams. Rocks and pebbles offer numerous habitats for aquatic insects.

Understanding Differences Along a Stream

The headwaters of a river system are very important to the health of the entire river because this is the source of much of the food carried downstream. Dams and weirs impede the distribution of food and seeds and the migration of aquatic animals, as well as allowing control of flow rates and flood frequencies.

Overhanging vegetation in forested areas provides much of the food (in the form of leaves, fruits, seeds, twigs and bark) required by stream organisms. This coarse material is converted to a finer fraction by physical abrasion, microbial activity and processing by macro-invertebrate 'shredders'. In headwater streams that are not shaded by streambank vegetation, attached algae and rooted aquatic plants produce most of the available food.

Middle catchment

In the middle reaches of the catchment the land is generally flatter; hence the flow of water in the stream is slower. Usually there is a combination of erosion on the outside edge of bends where the water flow is more rapid, and deposition of sediment in areas where the water flow is slower. Flooding may occur during peak water-flow periods, with deposition on well-defined flood plains.

In these middle reaches the streambank and its trees often no longer shade the entire water surface. Here the sun is able to warm the water, causing a slight increase in water temperature over the day and a drop in water temperature at night. The stream current usually slows in places, causing a warming of the water through greater absorption of the sun's rays. Thermal stratification can occur in the slow-flowing sections of the stream. Seasonal changes in water temperature are therefore greatest in this section. Attached algae become more abundant, and grazer (plant-eating) and collector macro-invertebrates dominate this section of the stream.

Lower catchment

As the stream gets very close to the sea or other large bodies of water, it travels very slowly and deposits the large quantities of sediment it has been carrying from further upstream. As the stream widens and gathers more flow it often becomes deeper and more turbid, thereby limiting sunlight penetration. Rooted plants may grow along the shoreline and some attached algae may also grow in the shallows if stones or other suitable substrate are available. Collector macro-invertebrates predominate in this stretch of the stream, filtering out accumulated minute particles suspended in the water and gathering fine particles that have settled to the river bottom.

The stream bottom becomes silty from accumulated upstream sediments. In slower stream reaches, less diffusion of atmospheric oxygen into the surface water takes place. This leads to even lower dissolved oxygen levels in the sediments. The breakdown of organic matter often decreases the dissolved oxygen level in the sediments even more. Organisms that are tolerant to lower oxygen levels are more common in this section of the stream.